NUMERICAL AND EXPERIMENTAL CHARACTERIZATION OF THE INSTANTANEOUS AND LONG-TERM BEHAVIOR OF INNOVATIVE AND SUSTAINABLE CONCRETES

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KEYWORDS: Fibres, FRC, MSFRC, SFRC, SCC, cracking, long-term behaviour

Fibre reinforced concretes are standard or high strength concretes to which steel, synthetic or natural fibres are added. The properties of this composite materials depend on the characteristics of the different components and on their dosages; in particular, for a given percentage volume of fibres the most important parameters are the mechanical and geometrical properties of the fibres, and the fibre-concrete bond. As part of this research, experimental tests have been carried out in order to evaluate the flexural tensile strength of FRC prisms, the long-term behaviour of plain and self-compacting concrete reinforced with either steel or synthetic fibres, the effects of temperature and the durability in aggressive environments of FRC beams. The results of the experimental tests allowed to compare the behaviour, for ultimate and serviceability loads, of elements reinforced with different types of fibres. Using the experimental data gathered, different hinge-based and sectional models were developed to describe the short-term mechanical behaviour of the FRCs as well as constitutive inverse analysis procedures to define the constitutive relationships for the FRCs. The long-term behaviour of self-compacting concrete was also studied as the higher amount of fines suggests the possibility of developing a greater deformation. Several experimental campaigns aiming at the study of both viscosity and shrinkage of SCC have been conducted. The development over time of both longitudinal and transverse deformation as well as other mechanical properties were measured and different stress levels were also considered. Based on the results obtained, a prediction model based on the Model Code 1990 was developed, modified by including the dependence on certain mix parameters and the development of resistance over time. SCC mixes were also used to cast beams in order to observe the development of deflection, the cracking behaviour with time and the residual strength at the end of the long-term loading. Current studies are mainly focused on the mechanical behaviour of SCC made with various types of fibres and recycling aggregates.

Fig. 1. Long-term tests on cracked FRC beams (Buratti).

Fig. 2. Uniaxial tension test on notched FRC specimens (Buratti).

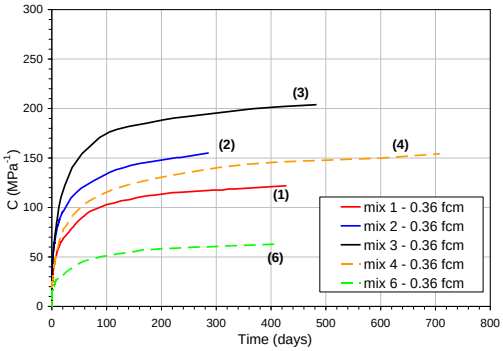

Fig. 3. Development with time of creep for different SCCs (Mazzotti).

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RESEARCH PROJECTS

2016-18: "Mater-SOS - MATERiali SOStenibili per il ripristino e la realizzazione di nuovi edifice", 2016-2018, founded by Regione Emilia Romagna, in the framework of the project POR-FESR 2014-2020.

2010-2013 e 2014-16: Research project funded by the Department of Civil Protection - Reluis tasks 1 and 3: "Reinforced Concrete Structures"; "Development and analysis of new materials for seismic retrofit (including new concretes)". National Coordinators: Proff. G. Manfredi, L. Ascione

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